General Relativity and Gravitation

Volume 14, 1982

Published Under the
Auspices of the International
COMMITTEE ON GENERAL RELATIVITY
AND GRAVITATION
GRG

Plenum Press · New York and London

INTERNATIONAL COMMITTEE ON GENERAL RELATIVITY AND GRAVITATION

Members L. Bel (Paris), P. G. Bergmann (Syracuse), V. A. Belinsky (Moscow), J. Bicak (Prague), B. Carter (Paris), Y. Choquet-Bruhat (Paris), R. Debever (Brussels), M. Demianski(Warsaw), G. F. R. Ellis (Cape Town), V. L. Ginzburg (Moscow), S. W. Hawking (Cambridge), P. Havas (Philadelphia), A. Held (Berne), A. Komar (New York), E. M. Lifshitz (Moscow), M. Magnusson (Reykjavik), S. Mavrides (Paris), E. T. Newman (Pittsburgh), M. Novello (Rio de Janeiro), R. Penrose (Oxford), J. Plebanski (Mexico City), A. K. Raychauduri (Calcutta), N. Rosen (Haifa), V. de Sabbata (Bologna), R. K. Sachs (Berkeley), R. Sexl (Vienna), J. Stachel (Boston), W. Thirring (Vienna), A. Trautman (Warsaw), Ya. B. Zeldovich (Moscow).

GRG A journal of studies in general relativity and related topics, published under the auspices of the International Committee on General Relativity and Gravitation (GRG)

Founded by P. G. Bergmann, H. Bondi, C. Cattaneo,† Mme. Y. Choquet-Bruhat, B. De Witt, P. A. M. Dirac, V. A. Fock,† J. Géhéniau, V. L. Ginzburg, O. Heckmann, D. Ivanenko, L. Infeld,† C. W. Kilmister, A. Lichnérowicz, A. Mercier, C. Møller,† A. Z. Petrov,† N. Rosen, L. Rosenfeld,† A. Schild,† J. L. Synge, Mme. M.-A. Tonnelat,† A. Trautman, H J. Treder, R. Utiyama, P. C. Vaidya, J. A. Wheeler

Editor A. HELD, Institut für Theoretische Physik, Universität Bern

Editor's office Institute of Theoretical Physics, Room 121, Sidlerstrasse 5, CH-3012 Berne, Switzerland

Honorary Editor A. Mercier

Contributions Manuscripts and editorial correspondence, as well as books for review, should be sent to the Editor's Office

Aims
- Publication of research papers on topics related to GRG
- Surveys and review articles on current research in GRG
- Details of GRG Conferences and other enterprises of interest to scientists working on GRG
- Book reviews
- Comprehensive bibliography and biographic reports, published as continuation of the Bulletin GRG

General Relativity and Gravitation is published monthly by Plenum Publishing Corporation, 233 Spring Street, New York, N.Y. 10013. Subscription orders should be addressed to the publisher. *General Relativity and Gravitation* is abstracted or indexed in Current Contents, INSPEC – Physics Abstracts, Mathematical Reviews, Referativnyi Zhurnal, Science Citation Index, Science Research Abstracts – Part A, and Zentralblatt für Mathematik.

© 1982 Plenum Publishing Corporation. *General Relativity and Gravitation* participates in the program of Copyright Clearance Center, Inc. The appearance of a code line at the bottom of the first page of an article in this journal indicates the copyright owner's consent that copies of the article may be made for personal or internal use. However, this consent is given on the condition that the copier pay the stated per-copy fee through the Copyright Clearance Center, Inc. for all copying not explicitly permitted by Sections 107 or 108 of the U.S. Copyright Law. It does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale, nor to the reprinting of figures, tables, and text excerpts.

Subscription rates:

Volume 14, 1982 (12 issues) $235.00 (outside the U.S., $265.00). Price for individual subscribers certifying that the journal is for their personal use, $85.00 (outside the U.S., $100.00).
Volume 15, 1983 (12 issues) $265.00 (outside the U.S., $298.00). Price for individual subscribers certifying that the journal is for their personal use, $85.00 (outside the U.S., $100.00).

Printed in the USA.

GRG

Volume 14, Number 1 **January 1982**

Contents

RESEARCH ARTICLES

Black Hole in a Gravitational Field
Robert M. Kerns and Walter J. Wild 1

Mappings of Empty Space-Times Leaving the Curvature Tensor Invariant
C. D. Collinson and Estelita da Graça Lopes Rodriguez Vaz 5

Exact Solutions for the Spherically Symmetric Vacuum Field in the General Scalar Tensor Theory
N. Van Den Bergh 17

Third Order Killing Tensors in the Schwarzschild Space-Time
Giacomo Caviglia and Clara Zordan 27

The Variational Principle of General Relativity
N. T. Bishop 31

Unified Geometric Theory of Electromagnetic and Gravitational Interactions
Marco Ferraris and Jerzy Kijowski 37

Inequivalent Metrics with Equal Spin Coefficients
Anders Karlhede and Jan E. Aman 49

Left-Flat Plane Waves as *H* Spaces
John R. Porter 53

Stability of Two-Dimensional Quasisingular Space-Times
D. A. Konkowski and L. C. Shepley 61

Geometrodynamics in Multidimensional Unified Theories
László Szabó 77

Some Global Properties of Closed Spatially Homogeneous Space-Times
Gregory G. Galloway 87

An Interior Solution for the Gamma Metric
B. W. Stewart, D. Papadopoulos, L. Witten, R. Berezdivin, and L. Herrera 97

BOOK REVIEWS

Proceedings of the International School of Physics "Enrico Fermi" Course 67: Isolated Gravitating Systems in General Relativity
A. Barnes 105

General Relativity. An Einstein Centenary Survey.
John Stachel 107

GRG

Volume 14, Number 2 February 1982

Contents

RESEARCH ARTICLES

On the Asymptotic Flatness of the *C* Metrics at Spatial Infinity
Tevian Dray 109

Insufficiency of Karmarkar's Condition
S. N. Pandey and S. P. Sharma 113

On Two "Self-Creation" Cosmologies
Garth A. Barber 117

A Spin-Coefficient Approach to Wesyssenhoff Fluids in Einstein-Cartan Theory
J. B. Griffiths and S. Jogia 137

Torques on a Nearly Rigid Body in a Relativistic Gravitational Field
Alessandro Caporali 151

On the Equivalence of the Relativistic Theories of Gravitation
Marco Ferraris and Jerzy Kijowski 165

The Force Law for the Dynamic Two-Body Problem in the Second Post-Newtonian Approximation of General Relativity
Reinhard A. Breuer and Ekkart Rudolph 181

GRG

Volume 14, Number 3 March 1982

Contents

RESEARCH ARTICLES

Solitonic Gravitational Waves in Bianchi II Cosmologies. 1. The General Framework
V. Belinski and M. Francaviglia 213

Stationary, Spherically Symmetric Solutions of Jordan's Unified Theory of Gravity and Electromagnetism
P. Dobiasch and D. Maison 231

Variational Formulation of General Relativity from 1915 to 1925 "Palatini's Method" Discovered by Einstein in 1925
M. Ferraris, M. Francaviglia, and C. Reina 243

Einstein-Kähler Surfaces and Gravitational Instantons
R. Catenacci and C. Reina 255

The Effect of the Electromagnetic Fields on the Evolution of Homogeneous Cosmological Models near the Singularity
B. L. Spokoiny 279

Gravitating Julia-Zee Dyon and the Cosmological Term
Masahiro Kasuya 293

Is Quantum Gravity Deterministic and/or Time Symmetric?
Don N. Page 299

BOOK REVIEWS

The Isotropic Universe
George Ellis 303

Relativistic Kinetic Theory
W. Israel 305

Calcul Tensoriel dans un Continuum Amorphe
H. Tran Van 307

GRG

Volume 14, Number 4 April 1982

Contents

RESEARCH ARTICLES

The Generalized Einstein–Maxwell Theory of Gravitation
V. N. Ponomariov and Ju. Obuchov 309

Birkhoff's Theorem for Ghost-Free, Tachyon-Free $R + R^2 + Q^2$ Theories with Torsion
Rick Rauch, Jiin Chang Shaw, and H.-T. Nieh 331

Black Holes and Everyday Physics
Jacob D. Bekenstein 355

Gravitational Radiation and the Motion of Bodies in General Relativity
F. I. Cooperstock and D. W. Hobill 361

Conformal Invariance and the Higgs Boson Mass in the Weinberg-Salam Theory with Gravitational Mechanism of Instability
V. M. Nikolaenko, G. N. Shikin, and K. P. Staniukowicz 379

The Cosmological Constant and the Color Charge at Energies of the Order of the Planck Mass
José M. Cerveró 393

Gas Dynamics in Strong Gravitational Fields
S. Hacyan 399

GRG

Volume 14, Number 5 **May 1982**

Contents

RESEARCH ARTICLES

A Generalization of Tensor Calculus and its Applications to Physics
Abhay Ashtekar, Gary T. Horowitz, and Anne Magnon-Ashtekar 411

Linearization Procedure for Cylindrically and Axially Symmetric Space-Times
Franco Bampi 429

Gravitational Interaction of Two Spinning Particles in General Relativity
J. Ibáñez and J. Martin 439

Cosmology without Singularity and Nonlinear Gravitational Lagrangians
Richard Kerner 453

Gravitational Radiation from a Binary System
P. H. Lim 471

Absorption of Gravitational Waves by Nearly Newtonian Systems
B. Linet 479

Remark on a Toroidal Detector of a Gravitational Wave
Keiji Omori, Akira Kuriyagawa, and Shinsaku Mori 493

Isotropic Focusing of Light Rays in Cosmology
Kjell Rosquist 503

On Cosmology, Topology and Field Theory
S. D. Unwin 509

GRG

Volume 14, Number 6 June 1982

Contents

RESEARCH ARTICLES

Gravitational Radiation Antennas Using the Sagnac Effect
J. Anandan and R. Y. Chiao 515

General Relativistic Chaos and Nonlinear Dynamics
John D. Barrow 523

Møller's Tetrad Theory of Gravitation as a Special Case of Poincaré Gauge Theory—A Coincidence?
Hildegard Meyer 531

Quantum Stationary States in the Bianchi Universes
T. Padmanabhan 549

Bianchi Type-1 Solutions for Modified Brans-Dicke Cosmology
A. Banerjee and N. O. Santos 559

A Proposed Laboratory Experiment to Measure G/G^1
Terry Dannehold 565

A Note on a Local Effect at the Schwarzschild Sphere
Anders Karlhede, Ulf Lindström, Jan E. Åman 569

Lagrangian Dynamics of Polarized Media
M. A. Schweizer 573

A Point-Particle Model Universe
R. P. A. C. Newman and G. C. McVittie 591

Spatially Compact Space-Times that Shrink
C. J. S. Clarke 609

GRG

Volume 14, Number 7 **July 1982**

Contents

RESEARCH ARTICLES

Half-Integral Spin from Quantum Gravity
John L. Friedman and Rafael D. Sorkin 615

Non-Self-Dual Nonlinear Gravitons
Philip B. Yasskin and James A. Isenberg 621

Low-Energy Behavior of a Quantized Scalar Field in the Linearly Expanding Universe
Takahiro Azuma and Akira Tomimatsu 629

Empty Spaces and Perfect Fluids with Homothetic Transformation
R. Debever and N. Kamran 637

Coordinate-Dependent 3 + 1 Formulation of the General Relativity Field Equations
Robert A. Nelson 647

Conformal Properties of Nonpeeling Vacuum Space-Times
Stephanie Novak and Joshua N. Goldberg 655

On Determining the Isometry Group of a Riemannian Space
A. Karlhede and M. A. H. Maccallum 673

A Unified Approach to Conservation Laws in General Relativity, Gauge Theories, and Elementary Particle Physics
Arthur E. Fischer 683

Einstein-Cartan-Maxwell-Bianchi Type-V Cosmological Models
Dieter Lorenz 691

Two Simple Solutions to Einstein's Field Equations
H. Stephani 703

Algebraic Interpretation to the Yang-Mills Field
H. Sokolin and J. Rosen 707

Erratum 713

Announcements 715

GRG

Volume 14, Number 8 **August 1982**

Contents

RESEARCH ARTICLES

Differential Rotation of an Electrically Conducting Fluid in General Relativity
M. Tsamplaris and D. P. Mason 717

A Note on the Derivation of the Kerr Metric
A. H. Klotz 727

The Hamiltonian in Relativistic Systems of Interacting Particles
Peter G. Bergmann and Arthur Komar 731

Nonexpanding Congruences of Null Strings in Algebraically Degenerate Right-Flat Spaces
Krzysztof Rózga 741

Coupled Gravitational and Electromagnetic Waves in Arbitrary Space-Times with Magnetized Plasmas and Dust, I
Reinhard A. Breuer 757

Nonsingular Cosmological Models in Brans-Dicke Theory
V. B. Johri, R. Chandra, and R. C. Srivastava 771

A Nonanalytic, Quasistationary Approximation Scheme Applied to a Model Problem
James L. Anderson and Lawrence S. Kegeles 781

Definitions of Black Holes Without the Use of the Boundary at Infinity
Andrzej Królak 793

The Gravitational Field of Static Spherically Symmetric Bodies
Walter Petry 803

GRG

Volume 14, Number 9 September 1982

Contents

RESEARCH ARTICLES

The Closed Trapped Region and the Apparent Horizon of Two Schwarzchild Black Holes
N. T. Bishop 817

A New Demonstration of Bonnor's Equation
Jaques Randon 825

Gauge Theory of Gravitation: (4 + N)-Dimensional Theory
Takeshi Fukuyama 829

Decomposition of the Space Covariant Two-Tensors on R^3
Alice Chaljub-Simon 843

Fluctuations Produced by the Cosmological Constant in the Empty Bianchi Type-IX Model
H. Sirousse-Zia 851

A Scalar Field Theory with a Variable Cosmological Term
Makoto Endo and Takao Fukui 869

Supersymmetric Dirac Particles in Riemann-Cartan Space-Time
Helmut Rumpf 873

Parametrized Post-Post-Newtonian (PP^2-N) Formalism for the Solar System
A. F. Sarmiento G. 893

GRG

Volume 14, Number 10 **October 1982**

Contents

RESEARCH ARTICLES

Globally Regular Solutions of Einstein's Equations
W. B. Bonnor 907

A Static Cosmological Model in Einstein-Cartan Theory
S. B. Kalyanshetti and B. B. Waghmode 923

A Description of the Gravitational Red Shift Borrowed from the Electrodynamics of Continuous Media
F. Pegoraro 931

Interacting with SHEEP
R. A. D'Iverno and I. Frick 935

Gravitational Effects on the Polarization Plane
F. Fayos and J. Llosa 965

Spherically Symmetric Solutions in Five-Dimensional General Relativity
Alan Chodos and Steven Detweiler 979

On the Relation between Causal Structure and Curvature
L. B. Szabados 991

GRG

Volume 14, Number 11 November 1982

Contents

PUBLISHER'S NOTE 999

RESEARCH ARTICLES

The Supergroups of Supersymmetry and Supergravity as Ordinary Real Lie Groups
Dieter W. Ebner 1001

Static Conformally Flat Solutions in a General Scalar-Tensor Theory of Gravitation
V. U. M. Rao and D. R. K. Reddy 1017

The Nonlinear Graviton: Superposition of Plane Waves
John R. Porter 1023

Energy Conditions and Stability in General Relativity
G. S. Hall 1035

General Relativity as a Soldered Nonlinear Sigma Model
Roberto Percacci 1043

The Lepton Brusselator: Creation of Structure in the Early Universe
Rainer E. Zimmermann 1051

Calculating Debye Potentials from Data on $\mathcal{J}$ or $\mathcal{H}$
R. J. Torrence 1061

Between General Relativity and Quantum Theory
Jerzy Rayski 1085

GRG

Volume 14, Number 12 **December 1982**

Contents

RESEARCH ARTICLES

Conformal Hyperbolicity of Lorentzian Warped Products
Michael J. Markowitz 1095

Clocks and Gravity
Alan A. Coley 1107

Electric Charge in the Kruskal Space-Time and the Jeans Conjecture
M. Demianski and I. D. Novikov 1115

Measurability Analysis of the Linearized Gravitational Field
P. G. Bergmann and G. J. Smith 1131

The Unified Field Theory, Combining Kaluza's Five-Dimensional and Weyl's Conformal Theories
Yu. S. Vladimirov 1167

General Solution for Flat-Space Longitudinal Momentum
Jeffrey M. Bowen 1183

Brinkmann's Theorem in General Relativity
W. D. Halford 1193

BOOK REVIEW 1197

ANNOUNCEMENT 1201

AUTHOR INDEX TO VOLUME 14 1203